Galileo on Tides

H. L. Burstyn 'Galileo's Attempt to Prove that the Earth Moves'. Isis 53 (1962) 161–85

says Galileo's theory had elements of truth in it.

replied to by F. J. Aiton ~~53~~ Isis 54 (1963) 265–6.

response by Burstyn. Isis 54 (1963) 400–1

Also Isis 56 (1965) 61–3.

(Aiton claims Galileo's tidal theory was quite wrong)

See also Annals of Science 10 (1954) 44–57 } and Isis 56 (1965) 56–61.

W. Wisan 'The New Science of Motion' good analysis of Days 3 & 4 of Discorsi

Arch. Hist. Ex. Sci 13 (1974) 103–306.

Galileo on Experiment

T. Settle: 'An experiment in the History of Science.' Science 133 (1961) 19–23.

— repeat of G's inclined plane expt.

N.B. rotation of ball only introduces a multiplying factor — relation as etc form 10. $s \propto t^2$.

Settle claims Galileo could (& did!) perform his experiments — not just thought experiments as claimed by Koyré eg.

Works on Galileo include

Koyré Galilean Studies

Clavelin

McMullin

Shapere etc.

See also Kuhn 'The Copernican Revolution' — very good book includes reference to Baker: 'Principles of Astronomy' for technical details. — Kuhn also discusses rather briefly Kepler, Galileo, Brahe, Descartes, Newton.

Kuhn 'The ~~History~~ of Black-Body Theory and the Quantum Discontinuity' is very clear account of early history of QM — Planck did not discover discontinuity — only Einstein.

H. Kangro 'The History of Planck's Radiation Law' is very good on the experimental background

R. Stuewer 'The Compton Effect' is very detailed study of Compton's work — not read carefully however

M. Klein 'Ehrenfest: The Making of a Theoretical Physicist' is very good book — good analysis of Ehrenfests' Encyclopaedia article

S.G. Brush 'The Kind of Motion we call Heat', is very good history of K.T. — supplements his earlier book.

J. Blackmore 'Ernst Mach' very good account of Mach, relation to Einstein

Books on History of Science etc

A. C. Crombie: 'St Augustine to Galileo', very clear chapter on scientific revolution' ditto C

Also Crombie: 'Robert Grosseteste and the Growth of the Experimental Method' discusses history of scientific method in the Middle Ages

Also Crombie Medieval, Early Modern Science (1967) (recommended by Franklin)

Very clear account by E. J. Dijksterhuis 'The Mechanization of the World Picture', 1961.

General histories by H. Butterfield 'The origins of Modern Science' — historian's classic.

and R. Hall The Scientific Revolution 1500-1800 (also 2 volume work by M. Boas-Hall & R. Hall)

Very detailed text on 'The Science of Mechanics in in the Middle Ages' by M. Clagett

First general detailed History of Science by G. Sarton (Just lists of 'facts' only sets up to Plato etc.

Neugebauer History of Ancient Astronomy very good on Ptolemy etc.

Best general history is Singer's A Short history of Scientific Ideas

cf also Dampier, Pledge (not v. good)

For Newton see I. B. Cohen 'Newton, Franklin' – good on Newton's methodology. The older one is F.A. Burtt 'The Metaphysical Foundations of Modern Physical Science'.

Gillespie 'The Edge of Objectivity' gives very clear fairly elementary account of history of ideas of science from 1500–1700 (rather similar to Singer)

R. Kargon 'Model & Analogy in Victorian Science'. J. Hist. Ideas 30 (1969) 423–436.

Nice account of French 'Molecular' school Laplace, Poisson, Cauchy, Navier — capillarity, elasticity etc. v. positivism of Fourier. 3rd way is Maxwell Analogy approach — use of metaphor rather than literal approach.

J. Dorling 'Maxwell's attempts to arrive at non-speculative foundations for the K.T.'. Studies 1 (1970) 229–248.

Good discussion of static explan. theory was rejected by Maxwell

G.A. Talbot & A.J. Pacey 'Some Early K.T. of gases: Herapath & his predecessors'
B.J.H.Sci 3 (1966) 133—149.

Good discussion of early work on K.T.

P.M. Heimann 'Faraday's Theories of Matter and Electricity' B.J.H.Sci 5 (1971) 235–257.

— seems best general account of electrotonic state v. lines of force as origin of electric action

J.W. Herivel 'Aspects of French Theoretical Physics in the Nineteenth Century'
B.J.H.Sci 3 (1966) 109—132.

— Good general discussion.

R. Fox 'The Rise & Fall of Laplacian Physics'
Hist. Stud. Phys. Sciences 4 (1974) 89-136
Imponderables act as particles over insensible distances only

Good general review.

See also
J.E. McGuire & P.M. Heimann
'Newton Forces Lockean Powers:
Concepts of Matter in 18th C. Thought'
Hist. Stud. Phys. Sci 3 (1971) 233-306
→ applications of Faraday's denial of matter (only forces).

→ Laplacian Physics looked for detailed molecular mechanisms, closely tied to theories of imponderable fluids, electric, magnetic, caloric etc — Note query as to whether aether theories do really get rid of action at a distance since aether is still fully particulate.

Additional references

R. Fox The Caloric Theory of Gases – from Lavoisier to Regnault (1971)

Caloric 1770 – 1850 – mainly French concept – imponderable fluid –
particles of gas stationary, surrounded by repulsive forces due to 'caloric [illegible] which ordinary matter.

Boorse, Motz The World of the Atom (1966)
includes papers by Dalton, Bernoulli, Herapath and Waterston and Joule
, Boscovich

R.B. Lindsay (ed.) 'Applications of Energy – 19th Century' 1976.

includes the Helmholtz paper (1847) and nice introduction by Lindsay of what was achieved.

J. Kestin (ed.) 'The 2nd Law of Thermodynamics' (1976)

includes Carnot, Clapeyron, Thomson, Clausius

Note T.A. Hirst (1887) The Mechanical Theory of Heat is a translation of Clausius' Collected works with supplements. W.R. Browne (1879) is without the supplements.

Ed. E Mendoza Reflections on the Motive Power of Fire (1960) – Carnot.
Quite useful introduction by Mendoza to the Complete text – conversion of caloric used by Carnot where we would now use entropy

Y. Elkana 'The Discovery of the Conservation of Energy', (1974) — main focus on Helmholtz — some discussion of the tradition in mechanics — also of Mayer's work — seems quite a good book.

cf F. Hiebert The Historical Roots of the Principle of Conservation of energy (1962) Mainly concerned heat and mechanical theories.

cf also R Lindsay Energy: Historical Development of the Concept (1975)

Maxwell's ~~Collected Pa~~ Scientific Papers

1.)	On Faraday's Lines of Force	I 155
2.)	On Physical Lines of Force	I. 451
3.)	A Dynamical Theory of the e.m.-field	I 598.

K. T.

1).	Illustrations of the Dynamical Theory of Gases	I. 377
2.)	On the Dynamical Theory of Gases	II. 26.

Misc.

Molecules	II. 361
Atom (Brit.)	II 445
Ether	II 763.
Attraction	II 485.

Faraday's Experimental Researches in Electricity

Series I. Vol. 1. pp. ~~6 – 139.~~ 1 – 41.
(E. M. Induction 1831)

—— Vol 2. A Speculation . . . on the Nature
of Matter p. 284 – 293.

—— Vol 3 On the physical character
of the lines of magnetic force
pp. 407 – 437.

Thoughts on Ray Vibrations
pp 447 – 452.

Note 4th vol. Experimental Researches in Chemistry, Physics…

John Tyndall Faraday as a
Discoverer, 1884 (4th ed.)
charming description of his scientific
work.

See also
P.M. Heimann 'Maxwell, Hertz and the Nature of Electricity', Isis 62 (1971), 149-157.

& 'Maxwell, the Modes of Consistent Representation', Archive Hist. Exact Sciences (1970) 6, 171-213
(very nice paper includes summary of Heimann's ideas on Faraday)

J. Bromberg 'Maxwell's Displacement Current and the Theory of Light', Arch. Hist. Exact Sciences 4 (1967/68) 218-34.

Faraday on Field Theory

P.M. Heimann, 'Faraday's Theories of Matter & Electricity', BJ.Hist.S. 5 (1971) 235–257. ('very clear reconstruction')

B.G. D~~[illegible]~~ Doran, 'Origins and Consolidation of Field Theory in 19th Century Britain: From the Mechanical to the Electromagnetic View of Nature'; HSPS 6 (1975), 132–~~1~~260. (good, long paper)

D. Gooding, 'Faraday, Thomson and the Concept of the Magnetic Field', BJ.Hist.S. 13 (1980) 91–129.

D. Gooding 'Conceptual & Experimental Bases of Faraday's denial of electrostatic action at a distance', Studies 9 (1978) 117–149.

D. Gooding 'Metaphysics v. Measurement: the Conversion & Conservation of Force in Faraday's Physics', Annals of Sc. 37 (1980) 1–29.

D. Gooding 'Final Steps to the Field Theory: Faraday's Study of Magnetic phenomena, 1845-1850.' HSPS 11 (1981) 231-275.

R.S. Westfall Force in Newton's Physics
— The Science of dynamics in the 17th Century.
(1971)

good discussion of Galileo, Descartes, Huygens
Leibniz & Newton's views on Mechanics

J. P. Joule 1818 – 1889.

On Matter, Living Force and Heat

Manchester 'Courier' 1847.

apparent loss of vis viva → heat

Heat = motion or attraction   J's says
          | P.E.   both involved
        K.E.

1843 'On the Calorific Effects of Magneto-Electricity and on the Mechanical Equivalent of Heat'

Mechanical work → Electrical energy in a dynamo → heat in a coil.

1845 Paddle-wheel experiment

'On the Existence of an Equivalent Relation between Heat and the ordinary Forms of Mechanical Power.'

Joule does not realize interdependence of all forms of energy, only certain steps mech → heat, Electrical → heat, so on.

C. Truesdell: 'The Tragicomical History of Thermodynamics 1822–1854', 1980

Idiosyncratic read, detailed reconstructions of Carnot, Clausius, Helmholtz etc..

H. J. Steffens James Prescott Joule and the Concept of Energy, 1979.

Discusses the extent to which Joule mirrored the general ideology of society. Ch

cf Cardwell, J. P. Joule, p 9
money + wine, women or song
but not wine to women etc

H. von Helmholtz: (1821–1894)

1847 'On the Conservation of Energy'

– classic general statement based on mechanical theory with central forces

≡ Erhaltung der Kraft.

E.N. Hiebert 'Historical Roots of the Principle of Conservation of Energy', 1962. (mainly 18th
17th century)

p.81 says Leibniz had notion of
vis mortua (P.E.)
as well as vis viva (K.E.)

Conservation of vis viva due to action of an object (i.e. loss of its energy) in producing motion from a height
& heat motion of invisible parts of a body.

Y. Elkana 'The Discovery of the Conservation of Energy', 1974.
Helmholz believed all phenomena in physics are mechanical -

2nd Law Thermodynamics

Kelvin · On the Dynamical Theory of Heat 1851

It is impossible by means of inanimate material agency to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest part of the surrounding objects.

Clausius (quoted in K's 1851 paper)

It is impossible for a self-acting machine unaided by any external agency, to convey heat from one body to another of a higher temperature

1862 $\oint \frac{dQ}{dT} \geq 0$ for reversible change

W. Thomson 1852 'On a Universal Tendency in Nature to the Dissipation of Mechanical Energy': because all real processes are irreversible, so energy differences cannot be restored (eff. of heat engine less than Carnot maximum)

S. Carnot (1796–1831) 'Reflexions on the Motive Power of ~~Heat~~ Fire.', 1824
— uses Caloric theory! [illegible]

Mathematical theory developed by
E. Clapeyron (1799–1864) developed mathematical ideas
& developed Carnot's heat eqn in 1834

W. Rankine (1820–1872) also enunciated 2nd law in 1850.

Kelvin on Thermodynamics (1824–1907)

'On an Absolute Thermometric Scale Founded on Carnot's Theory of the Motive Power of Heat, and calculated from Regnault's observations' – 1848 uses Caloric Theory

'On the Dynamical Theory of Heat' – 1851
gives up Caloric – states his version of 2nd law – refers to Clausius, 1854 Thomson states $\oint_{rev.} \frac{dQ}{T} = 0$ stat.

Clausius (1822–1888)

'On the Moving Force of Heat and the Laws regarding the Nature of heat itself which are deducible therefrom' 1850 – first statement of 2nd law of thermodynamics – Caloric → dynamical theory of heat.

Entropy Principle (1865) Ninth Memoir in series of 9.